

3-A Accepted Practices for the Design, Fabrication, and Installation of Milking and Milk Handling Equipment, Number 606-04

Formulated By
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

It is the purpose of the IAMFES, USPHS, and DIC in connection with the development of the 3-A Sanitary Standards Program to allow and encourage full freedom for inventive genius or new developments. Milking and milk handling equipment specifications heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time.

NOTE: Use current revisions or editions of all referenced documents cited herein.

A SCOPE

A1 These 3-A Accepted Practices shall pertain to equipment used in a milking system that begins with the equipment applied to the cow to extract milk and continues to all components in the system exclusive of the container in which the raw milk is stored or from which the milk is removed from the dairy farm.

A2 In order to conform with these 3-A Accepted Practices, milking and milk handling equipment shall comply with the following design, material, fabrication, and installation criteria.

B DEFINITIONS (See Appendix, Section J, Figures 1 & 2)

B1 *Product:* Shall mean raw milk.

B2 *Solutions:* Shall mean those homogeneous mixtures of chemical solute(s) and solvent used for flushing, cleaning, rinsing, and sanitizing.

B3 Surfaces

B3.1 *Product Contact Surfaces:* Shall mean all surfaces which are exposed to the product and surfaces from which liquids may drain, drop, or be drawn into the product.

B3.2 *Solution Contact Surfaces:* Shall mean the interior surfaces of the equipment or system

which are used exclusively for supply and recirculation of cleaning and/or sanitizing solutions, except those used to supply concentrated cleaning and/or sanitizing materials to the point of use.

B3.3 *Nonproduct Contact Surfaces:* Shall mean all other exposed surfaces.

B3.3.1 *Splash Contact Surfaces:* Shall mean other nonproduct contact surfaces that during normal use are subject to accumulation of soil and which require routine cleaning.

B4 Cleaning

B4.1 *Mechanical Cleaning or Mechanically Cleaned:* Shall mean soil removal by impingement, circulation, or flowing chemical detergent solutions and water rinses onto and over the surfaces to be cleaned by mechanical means in equipment or systems specifically designed for this purpose.

B4.1.1 *Cleaned In Place (CIP):* Shall mean mechanical cleaning of equipment, the cleanability of which has been sufficiently established such that all product or solution contact surfaces do not have to be readily accessible for inspection, i.e. silo-type tanks or welded pipelines.

B4.2 *Manual (COP) Cleaning:* Shall mean soil removal when the equipment is partially or totally disassembled. Soil removal is effected

with chemical solutions and water rinses with the assistance of one or a combination of brushes, nonmetallic scouring pads and scrapers, high or low pressure hoses and tank(s) which may be fitted with recirculating pump(s), and with all cleaning aids manipulated by hand.

B5 Pipelines

- B5.1 *Milk Line*: Shall mean rigid pipelines which have welded joints or sanitary fittings and are designed for mechanical cleaning and which are used for the dual function of transporting milk and air.
- B5.2 *Wash Line*: Shall mean rigid pipelines which have welded joints or have sanitary fittings and are used exclusively for the supply and recirculation of cleaning and/or sanitizing solutions, except those used to supply concentrated cleaning and/or sanitizing materials to the point of use.
- B5.3 *Main Air Line*: Shall mean the rigid pipe or tube from the vacuum pump through the sanitary trap to the receiver.
- B5.4 *Milk Transfer Line*: Shall mean a pipe which performs the single function of transporting milk.
- B5.5 *Pulsator Air Line*: Shall mean the rigid pipe or tube that supplies vacuum to the pulsator(s).

B6 Component Equipment

- B6.1 *Sanitary Fittings*: Shall mean welded or rolled-on fittings with gaskets to form joints designed for mechanical cleaning which form substantially smooth flush interior surfaces.
- B6.2 *Air Injector*: Shall mean a mechanical valve used to admit air intermittently into the washing system to increase the cleaning action.
- B6.3 *Short Pulse Tube*: Shall mean the flexible air hose or tube between the claw or unit mounted pulsator and the teatcup shell.
- B6.4 *Claw*: Shall mean the sanitary manifold (which may include a reservoir or claw bowl) that spaces the teatcup assemblies in a cluster and connects them to the long milk tube and may include a manifold to connect the long pulse tube to the short pulse tubes.
- B6.5 *Cluster*: Shall mean an assembly comprising teatcups and claw.
- B6.6 *Teatcup Jetters*: Shall mean the manifold assembly used to supply cleaning solutions through the claw and teatcup assemblies for mechanical cleaning in the milking parlor.
- B6.7 *Vacuum Tube*: Shall mean a flexible air tube or hose that connects a bucket milker to a vacuum line.

- B6.8 *Long Pulse Tube*: Shall mean a flexible air tube or hose that connects a pulsator to a claw.
- B6.9 *Milk Meter*: Shall mean in-line equipment that measures the quantity or rate of flow of milk from individual cows.
- B6.10 *Long Milk Tube (Milk Hose)*: Shall mean a flexible hose or tube that connects the claw or claw bowl to a bucket or a milk line or a milk transfer line.
- B6.11 *Milk Inlet*: Shall mean a nipple on the milk line or milk transfer line.
- B6.12 *Milk Cock (Milk Inlet Valve)*: Shall mean an open-close device incorporated in the milk inlet.
- B6.13 *Short Milk Tube*: Shall mean a tube that connects the teatcup liner to the claw inlet nipple.
- B6.14 *Nipple*: Shall mean a short pipe projecting from the claw, pulsator, milking machine lid, or other part of the milking system apparatus.
- B6.15 *Pipeline Milking Machine*: Shall mean a milking equipment system utilizing milk lines and/or milk transfer lines.
- B6.16 *Receiver*: Shall mean a vessel that receives milk from the milk line or milk transfer line.
- B6.17 *Releaser*: Shall mean a device that releases milk from under vacuum and discharges it to atmospheric pressure.
- B6.18 *Sanitary Trap*: Shall mean a flow vessel that separates the milk side of a milking machine system from the vacuum supply side to keep milk and fluids out of the vacuum system and to prevent back-flow of fluids.
- B6.19 *Slip-On Connectors*: Shall mean a nipple free of barbs over which a hose is positioned without any additional attachment.
- B6.20 *Stall Cock*: Shall mean the valve device on the pulsator air line to which the vacuum hose or pulsator is attached.
- B6.21 *Teatcup*: Shall mean the teatcup shell and liner or inflation.
- B6.22 *Teatcup liner or Inflation*: Shall mean a rubber or rubber-like flexible sleeve with mouthpiece and barrel which fits inside the teatcup shell. The liner may have an integral or separate short milk tube.
- B6.23 *Teatcup Shell*: Shall mean the metal or plastic case or shell in which the teatcup liner or inflation is enclosed.
- B6.24 *Transfer Station*: Shall mean a receptacle and piping or tubing system which conveys milk from the milking area to the container in which the milk is stored. Transfer stations are used with the pail or bucket type milking units.
- B6.25 *Vacuum Pump*: Shall mean an air pump(s) connected to a milking system that creates a suction and maintains partial vacuum.

- B6.26 *Bucket Milking Machine*: Shall mean a machine in which milk flows from the claw into a portable milk receiving bucket which is connected to the vacuum system.
- B6.27 *Distribution Tank*: Shall mean an air vessel or chamber, in the main air line between the vacuum pump and the sanitary trap, which acts as a manifold for other pipelines.
- B6.28 *Drop Lines for Mechanical Cleaning*: Shall mean those flexible hoses which connect wash lines to teatcup jetters or milk meters.
- B6.29 *Milk Cooling and Holding Tank*: Shall mean a vertical or horizontal cylindrical, rectangular, or oval or other equally satisfactorily shaped tank.
- B6.30 *Milking Parlor*: Shall mean a milking area where cows are present only when being milked.
- B6.31 *Milk Pump*: Shall mean a centrifugal or positive displacement pump which moves milk from the receiver to the milk holding tank.
- B6.32 *Pulsator*: Shall mean a device for producing cyclic pressure change inside a teatcup shell.
- B6.33 *Vacuum Milk Holding Tank*: Shall mean a milk cooling and holding tank which is under vacuum during milking.
- B7 *Simple Hand Tools*: Shall mean implements normally used by operating and cleaning personnel such as a screwdriver, wrench or hammer.

C MATERIALS

C1 Metals

The materials of product contact surfaces of equipment included in the milking system for which there are 3-A Sanitary Standards or 3-A Accepted Practices shall comply with the material criteria of the applicable standards or accepted practices.

- C1.1 Other product contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series¹ or corresponding Alloy Cast Institute (ACI) types² (See Appendix, Section H), or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent, except that:
- C2 Nonmetals
- C2.1 Glass may be used for milk lines, milk transfer lines, receivers, receiver air lines, claws, fittings, and elbows, and shall be of a clear, heat-resistant type.
- C2.2 Rubber and rubber-like materials may be used in sealing applications, long air hoses, milk hoses, short milk tubes, vacuum tubes, long and short pulse tubes, filter parts, teatcup liners, teatcup

jetters, O-rings, drip deflectors, level sensing devices (probes), sensor insulators, and parts having the same functional purposes.

- C2.2.1 Rubber and rubber-like materials, when used for the above specified application(s), shall conform with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18.
- C2.3 Plastic materials may be used in sealing applications, transparent flexible tubing for transfer stations, milk hoses, short milk tubes, milk line fittings, vacuum tubes, long and short pulse tubes, plug-type valves, sight and light openings in product or solution pipelines, milk lines or wash lines, filter parts, teatcup liners, O-rings, drip deflectors, level sensing devices (probes), sensor insulators, teatcup jetters, metering devices, releasers, claws, pipeline drain assemblies, air injectors, buckets and bucket lids, float balls and milk inlets and parts having the same functional purposes.
- C2.3.1 Plastic materials when used for the above specified application(s) shall conform with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20.
- C2.4 Bonded rubber and rubber-like materials and bonded plastic materials having product contact surfaces shall be of such composition as to retain their surface and conformational characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment.
- C2.5 The final bond and residual adhesive, if used, on bonded rubber and rubber-like materials and bonded plastic materials shall be nontoxic.³
- C2.6 Where materials having certain inherent functional purposes are required for specific applications, such as probe coatings and rotary seals, carbon and/or ceramic materials may be used. Carbon and/or ceramic materials shall be inert, nonporous, nontoxic, nonabsorbent, insoluble, resistant to scratching, scoring, and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment.
- C3 Solution contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series or corresponding Alloy Cast Institute (ACI) types (See Appendix, Section H), or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent, or of clear heat resistant glass

pipings. Rubber and rubber-like materials or plastic materials complying with C2.2.1 or C2.3.1 may be used for sealing applications and for short flexible takedown jumpers or slip-on connectors.

C4 Nonproduct Contact Surfaces

C4.1 All nonproduct contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All nonproduct contact surfaces shall be relatively nonabsorbent, durable, and cleanable. Parts removable for cleaning having both product contact and nonproduct contact surfaces shall not be painted.

C5 Main air lines and/or pulsator air lines shall be made of materials which will withstand periodic cleaning. If these lines are used as part of the product contact surface cleaning circuit, they must comply with Section C3.

C6 Paper gaskets shall not be used.

D FABRICATION

D1 The fabrication criteria of equipment included in the milking system for which there are 3-A Sanitary Standards or 3-A Accepted Practices shall be those of the applicable standards or accepted practices. (See Appendix, Section T.)

D2 Other equipment shall conform to the following fabrication criteria.

D2.1 Surface Texture

D2.1.1 All product and solution contact surfaces shall have a finish at least as smooth as a No. 4 ground finish on stainless steel sheets and be free of imperfections such as pits, folds, and crevices in the final fabricated form (see Appendix, Section I), except that:

D2.1.1.1 The solution contact surfaces for castings for pumps shall be at least as smooth as ACI Surface Indicator Scale SIS-1. (See Appendix, Section K.)

D2.2 All permanent joints in metallic product contact surfaces shall be continuously welded except that rolled-on fittings may be used as provided for in 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63-.

D2.3 Gaskets

D2.3.1 Gaskets having a product or solution contact surface shall be removable or bonded.

D2.3.2 Grooves in gaskets shall be no deeper than their width unless the gasket is readily removable and reversible for cleaning.

D2.3.3 Gasket grooves or gasket retaining grooves in product contact surfaces for removable gaskets shall not exceed 1/4 in. (6.35 mm) in depth or be less than 1/4 in. (6.35 mm) wide except those for standard O-rings smaller than 1/4 in. (6.35 mm), and those provided for in Section D2.9.

D2.4 Radii

D2.4.1 All internal angles of less than 135° on product contact surfaces shall have radii of not less than 1/4 in. (6.35 mm) except that:

D2.4.1.1 Smaller radii may be used when they are required for essential functional reasons, such as those in O-ring grooves, claw assemblies, and milking machine lids. In no case shall such radii be less than 1/32 in. (0.794 mm).

D2.4.1.2 The radii in gasket grooves, gasket retaining grooves, or grooves in gaskets, and those provided for in Section D2.9 and except for those for standard 1/4 in. (6.35 mm) and smaller O-rings, shall be not less than 1/8 in. (3.18 mm).

D2.4.1.3 The radii in grooves for standard 1/4 in. (6.35 mm) O-rings shall not be less than 3/32 in. (2.38 mm) and for standard 1/8 in. (3.18 mm) O-rings shall be not less than 1/32 in. (0.794 mm).

D2.4.2 The minimum radii for fillets of welds in product contact surfaces shall be not less than 1/4 in. (6.35 mm) except that the minimum radii for such welds may be 1/8 in. (3.18 mm) when the thickness of one or both parts joined is less than 3/16 in. (4.76 mm).

D2.5 Openings in Covers

D2.5.1 All milk lines and/or milk transfer lines and other appurtenances entering through the lid or cover of the cooling and/or holding tank, and not permanently attached to the cover, shall be fitted with a sanitary drip deflector that overlaps the edges of the opening through the cover and is located as close as possible to the cover.

D2.6 Drainage

D2.6.1 The bottom of all product containers (surge tanks, distribution tanks, and receivers) which have a sanitary connection outlet shall have at least a 1/4 in. per ft. (21 mm per m) pitch to the outlet.

D2.7 Metal tanks

D2.7.1 Metal tanks used as surge tanks, distribution tanks, and receivers shall comply with 3-A Sanitary Standards for Uninsulated Tanks for Milk and Milk Products, Number 32-.

D2.8 **Cleaning and Inspectibility**

D2.8.1 Milking systems that are to be mechanically cleaned shall be designed so that the product contact surfaces of the milking system and all nonremoved appurtenances thereto can be mechanically cleaned and are easily accessible and readily removable for inspection and the following:

D2.8.1.1 Each separate cleaning circuit, including product and solution lines, shall be provided with a sufficient number of access points, such as valves, fittings or removable sections to make possible adequate inspections and examinations of representative interior surfaces.

D2.8.2 Product contact surfaces not designed to be mechanically cleaned shall be easily accessible for cleaning and inspection either when in an assembled position or when removed. Removable parts shall be readily demountable.

D2.8.3 All product contact and solution contact surfaces shall be cleanable, either when in an assembled position or when removed. System appurtenances shall be accessible for inspection. Removable parts shall be readily demountable.

D2.9 Plastic or rubber hoses used under vacuum, such as vacuum tubes, long pulse tubes, milk hoses, short milk tubes, inflations, and drop lines for mechanical cleaning, may utilize slip-on connectors.

D2.10 All sanitary fittings and connections shall conform to the 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63-, 3-A Sanitary Standards for Plug-Type Valves for Milk and Milk Products, Number 51-, 3-A Sanitary Standards for Thermoplastic Plug-Type Valves for Milk and Milk Products, Number 52-, or 3-A Sanitary Standards for Compression-Type Valves for Milk and Milk Products, Number 53-, except that plastic fittings and connections that comply with Section C2.3.1 and glass fittings and connections that comply with Section C2.1 may be used.

D2.11 Lines and fittings for the application of air under pressure shall comply with the applicable provisions of 3-A Accepted Practices for Air Under Pressure in Contact with Milk, Milk Products, and Product Contact Surfaces, Number 604-.

D2.12 **Springs**

D2.12.1 Any coil spring having product contact surfaces shall have at least 3/32 in. (2.38 mm) openings between coils, including the ends when the spring is in the free position.

D2.13 Bonded rubber and rubber-like materials and bonded plastic materials having product

contact surfaces shall be bonded in a manner that the bond is continuous and mechanically sound so that when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment, the rubber and rubber-like material or the plastic material does not separate from the base material to which it is bonded.

D2.14 **Nonproduct Contact Surfaces**

D2.14.1 Nonproduct contact surfaces shall have a smooth finish, free of pockets and crevices, and be readily cleanable. Surfaces to be coated shall be effectively prepared for coating to assure adhesion.

E **FABRICATION - SPECIFIC ITEMS**

The following are requirements for specific items.

E1 **Milking Machine Pails and Transfer Stations**

A tipping handle, located near the bottom, shall be provided on a floor type pail. Handles and brackets shall be permanently attached to the equipment. A lid shall be provided for both floor and suspended-type pails. Bails, handles, chines, and legs on both types of milking machine pails shall be considered nonproduct contact surfaces.

E1.1 Lids or covers shall be provided for milking machine pails, milk carrying pails, and transfer station receptacles. Lids on transfer station receptacles shall be self closing. All ungasketed lids shall have over-lapping edges turned down at least 3/8 in. (9.52 mm) below the top of the milk pail or receptacle. The lids or covers on the milking machine pails, milk carrying pails, and transfer stations shall be pitched to an outside edge(s) so as to be free draining.

E1.2 The transparent plastic tubing used in conjunction with a transfer station shall be one continuous piece.

E1.2.1 Equipment for air drying transfer tubing shall be provided. The air drying equipment shall comply with the applicable provisions of the 3-A Accepted Practices for Air Under Pressure in Contact with Milk, Milk Products, and Product Contact Surfaces, Number 604-.

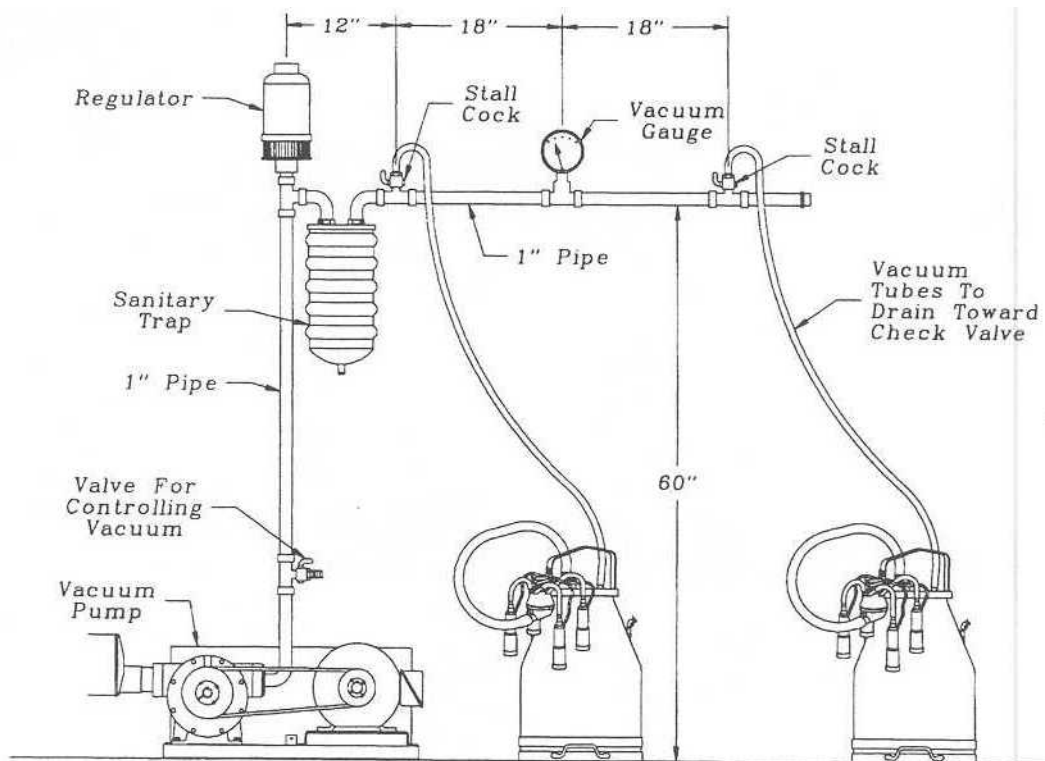
E1.3 Pumps used for product contact, if supplied, shall conform to the 3-A Sanitary Standards for Centrifugal and Positive Rotary Pumps for Milk and Milk Products, Number 02-.

E1.4 Pumps, when used, shall be actuated by a milk level sensing device. All product contact surfaces of the device shall be readily demountable for inspection and shall be located so that all of the product contact surfaces are

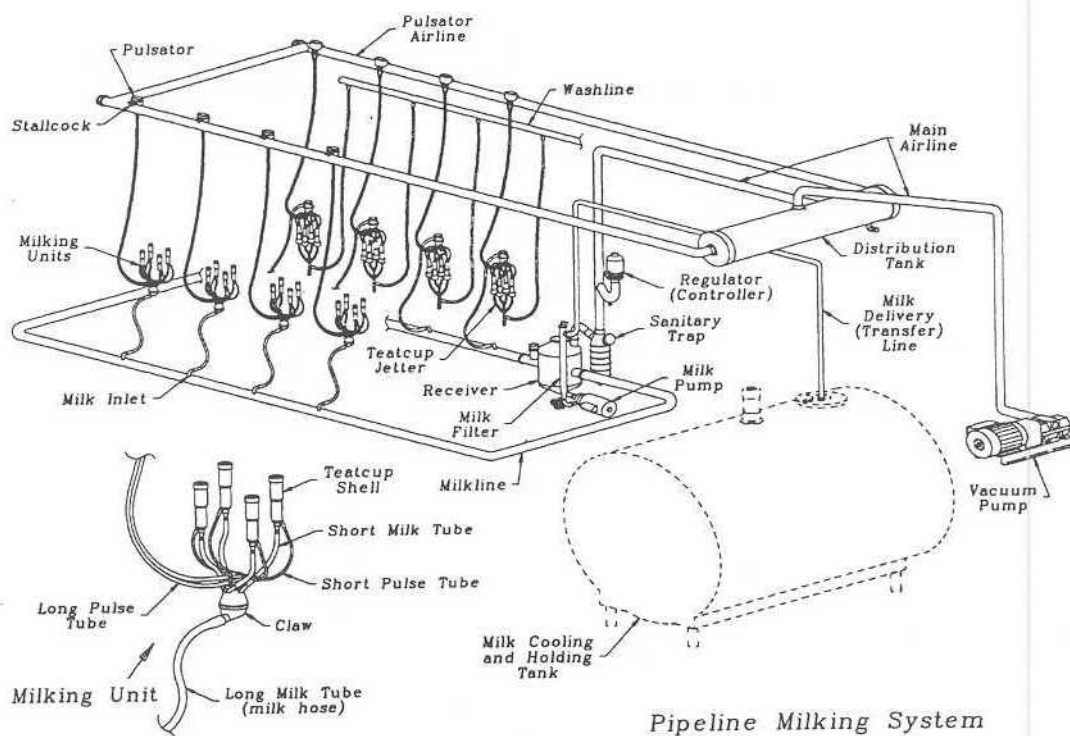
	reached by rinse, wash, and sanitizing solutions.	E5.4	Milk lines shall be supported so that they remain in alignment and position. (See Appendix, Section S.) The support system shall be designed so as to preclude electrolytic action between support(s) and milk line(s).
E1.5	The carriage shall be constructed of smooth corrosion resistant material. Tires shall be smooth and without threads.		
E2	Milker Claws	E5.5	Each separate cleaning circuit, including product and solution pipelines (wash lines), shall be provided with a sufficient number of access points, such as valves, fittings, or removable sections to make possible adequate inspection and examination of representative interior surfaces. All mechanically cleaned milk line product contact surfaces shall be exposed to cleaning and sanitizing solutions during cleaning.
E2.1	Nipples for long and short milk tubes shall be flush with the interior surface of the claw bowl.		
E2.2	The claw shall be designed so that cleaning and sanitizing solutions will drain when the claw is in the cleaning and sanitizing position.		
E2.3	Automatic cluster removers, when used, shall shut the vacuum off to the claw prior to removal to prevent extraneous material from being drawn into the cluster. The design and/or adjustment shall be such that the cluster is not dragged across the floor at removal.	E5.6	The milker unit (cluster and long milk tube) cleaning manifold shall not be located in the milk line.
E3	Sanitary Check Valves	E5.7	Milk lines and wash lines shall be self-draining except for normal clingage, and shall have a minimum continuous slope of at least 1 in. per 10 ft (8.3 mm per m) from a high point. (Also see Section E8.2 and E8.5.)
E3.1	A bucket type milking machine shall be provided with a sanitary check valve or other device that will prevent moisture or any contaminating substance from entering the milk from the vacuum system. A sanitary check valve or other device that will pass the test methods found in Appendix, Section J is considered to meet this provision.	E5.8	Milk inlets and milk inlet valves, where provided, shall be self-draining into the milk lines and/or milk transfer line and installed so that milk enters the upper half of the milk line. All milk inlet valves shall be supplied with closures which are readily applied and are of sanitary design.
E3.2	The movable portion of the sanitary check valve shall be of one piece construction or the parts shall be bonded together.	E5.9	The milk line and/or milk transfer line couplings or unions shall not be located in openings in walls, solid partitions, etc. through which the milk line and/or milk transfer lines pass. Where necessary, protective shields shall be used. The openings between the milk line and wall shall be protected to prevent the entrance of flies and other insects into the milkroom.
E4	Filters		
E4.1	Filters shall conform to the 3-A Sanitary Standards for Milk and Milk Products Filters Using Disposable Filter Media, Number 10.	E5.10	Milking systems shall be physically disconnected from the cleaning make-up vats during milking to avoid contamination by solution in the vat.
E4.2	Wire mesh or woven material shall not be used for the filter medium support.		
E5	Milk Lines and/or Milk Transfer Lines and/or Wash Lines	E5.11	Milk lines shall be installed so that the vertical distance from the platform on which the cow stands to the center of the milk line, does not exceed 7 ft (2.1m) when milk is moved by vacuum directly from the milker unit assembly to the milk line except for cross overs. Opaque long milk tubes shall not exceed 8 ft (2.4 m) in length.
E5.1	All solution contact surfaces shall be at least as smooth as a No. 4 ground finish on stainless steel sheets except as provided in Section D2.1.1.1.		
E5.2	Permanently mounted product and solution pipelines shall have sanitary fittings or welded joints.	E5.12	There shall be no risers in the milk line. Any upward slope encountered by the milk moving toward the receiver is considered a riser. Vertical sanitary pipelines, such as cross over pipelines, which do not convey milk are not considered risers.
E5.3	All product contact sanitary pipeline (tubing) shall conform to the 3-A Sanitary Standards for Polished Metal Tubing for Dairy Products, Number 33- or be of a clear, heat resistant glass.		

E5.13	In a pipeline milking system, there shall be no cross-connection(s) between the safe water supply and any unsafe or questionable water supply, or any source of pollution through which the safe water supply might become contaminated. For example, a connection between the water supply piping and solution make-up tank, unless protected by an air gap or effective back-flow preventer, constitutes a violation of this practice.	E8.2	Main air lines and/or pulsator air lines shall be pitched at least 1/2 in. in 10 ft (4.2 mm per m), preferably in the direction of air flow.
E5.14	A milk transfer line connecting the milk pump or releaser and milk cooling and holding tank shall be a rigid pipe or tube with welded joints or permanently installed sanitary fittings.	E8.3	An automatic drain valve or a self draining sanitary trap shall be installed at the bottom of all risers which are not self-draining.
E6	Vacuum Pumps	E8.4	Stall cocks shall enter the upper half of the line.
E6.1	Oil-containing exhaust from a vacuum pump shall not terminate in a milking barn, stable, parlor, milkroom or feedroom.	E8.5	In a pipeline milking machine, a self-draining sanitary trap shall be provided whenever the milk line or a permanently installed solution pipeline (wash line) is connected to a vacuum supply line. The trap shall be installed adjacent to the milk receiver, releaser, wash vacuum pipeline or vacuum milk holding tank and connected by readily disassembled sanitary piping. From the top intersection of the outlet on the receiver, the vertical rise of this connection shall not exceed 12 in. (30.5 cm) as measured to the bottom of the connecting elbow. The connecting sanitary piping shall slope toward the sanitary trap at least 1/2 in. (13 mm) in the first 2 ft (61 cm) and the remainder of the pipe shall slope a minimum of 0.8%. The sanitary trap shall be installed so that any liquid collected in the sanitary trap cannot get back into the receiver, releaser, or vacuum milk holding tank. Sanitary traps designed for mechanical cleaning may be cleaned by reverse flow.
E7	Vacuum Regulators and Air Admission	E8.6	If a distribution tank is used, it shall be self-draining except for normal clingage.
E7.1	During the milking cycle a regulator shall not admit air directly into the milk line.	E9	Milk Receiver, Pump, and Releaser
E7.2	Air may be admitted into the milk line and/or milk transfer line for purposes of "shut down" by valves or other acceptable means located in the milkroom only. A valve for "shut down" purposes may not be installed in nonproduct contact lines unless a check valve is installed adjacent to the sanitary trap and in such a manner that will permit air to travel only to the vacuum pump.	E9.1	The milk level sensing device shall be designed so that milk will not reach the lowest inlet in the milk receiver.
E7.3	Air admission bleed holes (or air vents), if provided, shall be in the upper half of the claw or claw bowl when it is in the milking position or in the teatcup assembly.	E9.2	When a centrifugal or positive rotary type milk pump is used to remove the milk from the receiver, it shall conform to the 3-A Sanitary Standards for Centrifugal and Positive Rotary Pumps for Milk and Milk Products, Number 02-. The pump shall be located so that it is readily accessible for cleaning and/or inspection.
E7.4	An air injector, if provided, shall be located to admit clean air into the pipeline during the washing process. The timing and air-to-water ratio shall be adjusted so all surfaces are exposed to wash solution with enough turbulence to clean the system. The air injector shall be designed, installed, and operated so that air is not admitted during milking. Air injectors shall be located in the milk house or room of equivalent cleanliness, or shall be provided with an appropriate filter and properly protected from contamination. Air injectors mounted on the milk line shall be of sanitary design.	E9.3	The pump shall be actuated by a level sensing device. All product contact surfaces of the device shall be readily demountable for inspection and shall be located so that all of the product contact surfaces are reached by the rinse and wash solutions.
E8	Main Air Lines and/or Pulsator Air Lines	E9.4	A releasing mechanism, when provided, shall be of a sanitary design, and operated so that the milk will not reach the lowest milk inlet of the receiver during milking.
E8.1	Main air lines and/or pulsator air lines shall be supported in such a manner that the lines will properly drain.		

E9.5	The pump and interconnecting piping shall be installed so that they are self-draining except for normal clingage. Drains shall terminate above the floor and shall not be connected to sewage lines.	E12.4	Recirculated cold water which is used in plate or tubular heat exchangers shall be from a safe source, shall be nontoxic, and shall be protected from contamination. Such water shall be tested semiannually and shall comply with appropriate bacteriological standards.
E10	The teatcup jetters in the parlor shall be covered during milking.	F	MANUFACTURER'S INSTRUCTIONS
E10.1	Cluster cleaning devices such as teatcup jetters, when installed outside the milkroom, shall be constructed as to prevent insects, rodents, dirt, dust, and other contaminants from gaining access to milk contact surfaces and solution contact surfaces. They shall provide complete drainage, except for normal clingage, of clusters, long milk tubes, and solution contact surfaces.	F1	The manufacturer shall furnish instructional charts and literature on milking systems giving the maintenance schedules and operational instructions. This shall include the recommended assembly and disassembly procedures of all components. It shall also include lubrication and maintenance schedules for vacuum pumps, milk pumps, pulsators, and vacuum regulators.
E11	Automatic Backflush Systems	G	APPLICATION TO INSTALL PIPELINE MILKING MACHINES
E11.1	When backflush is used, it shall include a valve between the claw and the milk inlet which provides a complete separation, with an air gap, between the solution inlet and milk line.	G1	Prior to the installation of a pipeline milking machine, the producer shall first make application on a suitable form, as prescribed by the control authority, or in the absence of a required form, on a form as suggested herein (See Appendix, Section U). The producer shall provide the control authority with two copies of the necessary details and flow diagrams. Approval of the application shall be obtained prior to the starting of installation.
E11.2	The backflush cycle shall include a pre- and post-rinse with safe water.	G2	Changes in existing milking systems, affecting capacity or arrangement, shall be submitted to the control authority.
E11.3	After final rinse, any remaining water shall be blown from the cluster with compressed air or removed from the unit by vacuum. This is to be accomplished before the valve returns to the milking position.		
E11.4	If compressed air is used to blow water from the unit or injected into the sanitizer or rinse solution, the air must be produced using equipment conforming with the 3-A Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products and Product Contact Surfaces, Number 604.		
E12	Heat Exchangers		APPENDIX
E12.1	When plate heat exchangers are used as milk coolers in milking systems, they shall conform to 3-A Sanitary Standards for Plate Heat Exchangers for Milk and Milk Products, Number 11.	NOTE:	This Appendix is an adjunct to the preceding section of these practices. Its purpose is to provide supplemental information and nonnormative guidance in the design, fabrication and installation of milking machines.
E12.2	When tubular heat exchangers are used as milk coolers in milking systems, they shall conform to 3-A Sanitary Standards for Tubular Heat Exchangers for Milk and Milk Products, Number 12.	H	STAINLESS STEEL MATERIALS
E12.3	Other types of heat exchangers, such as refrigerated receivers, if used as milk coolers in milking systems, shall conform with the applicable criteria in Sections C and D of 3-A Accepted Practices for the Design, Fabrication and Installation of Milking and Milk Handling Equipment, Number 606.		Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of Section C1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C1.2 sets forth the chemical ranges and limits of acceptable stainless steel of the 300 Series. Cast grades of stainless steel corresponding to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. The chemical compositions of these cast grades



- Note:
1. Install Regulator And Vacuum Gauge Per Manufacturers Specifications.
 2. Stall Cocks To Be Positioned Per Manufacturers Specifications.



- L INSTALLING, SIZING AND PERFORMANCE GUIDELINES**
- The installing, sizing, and performance guidelines outlined in American Society of Agricultural Engineers (ASAE) Standard: ASAE S-518 Milking Machine Installations, Construction and Performance⁶ should be followed.
- M MAIN AIR LINES AND/OR PULSATOR AIR LINES**
- M1** Pipe and fittings used in main air lines and/or pulsator air line installations should be capable of withstanding vacuums of 25 in. (635 mm) of mercury without collapsing.
- M2** Pulsator air lines should be looped to (1) a vacuum distribution tank or (2) a vacuum pulsator header line. A single header line should be a minimum of one size larger than the pulsator air line, unless the pulsator air line is sized larger than the minimum size specified in ASAE S-518. (See Appendix, Section L.)
- N MILK LINE AND VACUUM SYSTEM CAPACITY**
- N1** The milk line size should be deemed to be sufficient if, upon installation of a milking system, it meets the maximum milk line vacuum drop in accordance with Appendix, Section L.
- N2** The vacuum system should be deemed to have sufficient capacity if, upon installation of a milking system, it meets the vacuum capacity and reserve performance criteria in accordance with Appendix, Section L.
- O OPERATION, MAINTENANCE, AND SERVICE**
- O1 Installation Check**
- O1.1** It is recommended that immediately after installing, the installer should perform the dynamic milk test according to ASAE EP 445 - Test Equipment and Its Application for Measuring Milk Handling Equipment.
- O.2 Service Check**
- O2.1** It is strongly recommended that a complete service check and milking system performance evaluation be performed by an authorized milking machine dealer on an hourly use basis as recommended by the machine manufacturer or at least once a year. The suggested test should include (1) operating vacuum level, (2) vacuum pump capacity, and (3) effective reserve. It is highly desirable that a service report and milking system test report be supplied by the milking machine manufacturer and followed closely by their authorized dealer during the service check. A copy of the completed report should be furnished to the owner.
- O3 Vacuum System**
- The following recommendations, if followed, should aid in trouble-free operation of the vacuum system.
- O3.1 Vacuum Pump**
- O3.1.1** Use only oil recommended by the manufacturer and maintain it at proper level. Change oil as frequently as recommended by the manufacturer.
- O3.1.2** Consult a qualified dealer and the control authority before adding units to a milking system.
- O3.1.3** Keep pulleys and belts free of oil and grease. Check the operator's manual for the proper belt tension. Keep shields and guards in place.
- O3.2** Check the pulsator(s) as recommended by the manufacturer to see that it is properly adjusted.
- O3.3** Check vacuum tubes and main air lines and/or pulsator air lines weekly, and clean as needed. Any leak in the vacuum pipeline should be corrected immediately.
- O3.4** Check for vacuum leaks in all stall cocks, milk inlets, valves, gaskets, and other fittings.
- O3.5** Check and clean vacuum regulator and sanitary traps weekly.
- O4 Milker Units**
- O4.1** Teatcup liners or inflations should be changed as recommended by the manufacturer and damaged parts should be replaced immediately.
- O4.2** Only milk hoses, short milk tubes, short pulse tubes, long pulse tubes, and vacuum tubes of the recommended inside diameter should be used. Hoses and tubes should be kept free of obstructions and kinks.
- P RELEASER**
- P1** The operation of the releaser should not cause the vacuum in the system to drop more than 1 in. (25.4 mm) of mercury.
- Q TRANSFER STATIONS**
- Q1** To prevent excessive agitation and incorporation of air into the milk, pump type stations should be equipped with level sensing devices to start and stop the pump motor. Vacuum operated stations should be equipped with check valves for the same purpose.

R CLEANING AND SANITIZING PROCEDURES

R1 A rinsing, cleaning, and sanitizing regimen which has been demonstrated to be effective should be employed. Prior to installation, a description of the cleaning regimen that has been determined to be effective should be made available to the producer. Because of the possibilities of corrosion, the recommendations of the cleaning compound manufacturer should be followed with respect to the time, temperature, and the concentration of specific detergent solutions and bactericides. To insure proper strength of solution and to avoid corrosion, the cleaning compound should be completely dissolved or dispersed prior to circulation. One regimen found to be satisfactory is as follows:

R1.1 Immediately after concluding each milking, all connections between wash lines and milking equipment are made; equipment which is not included in the cleaning circuit is removed, the openings are capped, by-pass connections are made, and lines are rinsed thoroughly with tepid water at 90° to 105°F (32° to 40°C) entering circuit, continuously discarding the water at the downstream end of the solution return line until the discarded effluent is clear.

R1.2 All solution and product contact surfaces not cleanable by mechanical cleaning procedures such as valves, slip joints, milk inlets, etc. should be cleaned manually.

R1.3 An effective detergent solution should be circulated for a period of time at a concentration and temperature capable of effectively removing the soil residue in the circuit.

R1.4 The detergent solution should be thoroughly rinsed from the circuit with an acid solution.

R1.5 Immediately prior to the next milking, the line should be rinsed with clean water to which an approved sanitizing agent has been added. Then let drain before starting to milk.

R2 Provisions should be made for adequate warm water under pressure to be available for cleaning the outside or nonproduct contact surfaces of the cluster including tubes. Dismantling for replacing rubber parts and/or manual cleaning of product contact surfaces should be done in the milkroom.

R3 Provide means by which milk measuring devices which are not mounted permanently on the milking system but are used occasionally (for example, monthly) can be cleaned per manufacturer's recommendations.

R4 Water heating capacity is considered adequate if the detergent solution in the wash vat is maintained at a minimum of 120°F (50°C). Manufacturer's recommendations for water requirements should be followed. Use the

information below to determine the amount of water to wash the milking system.

R4.1 Hot Water Requirements

Calculate the amount of hot water in the vat for washing per the following table. The amounts are valid for an ambient temperature down to 50°F (10°C) and when the water temperature is

Component	Water Requirement
1 1/2 in. (33.10 mm) Drawlines, Wash Lines, and Milk Lines	0.4 gal/10 ft (0.5 L/m)
2 in. (50.80 mm) Drawlines, Wash Lines, and Milk Lines	0.6 gal/10 ft (0.7 L/m)
2 1/2 in. (63.50 mm) Milk Lines	0.8 gal/10 ft (1.0 L/m)
3 in. (76.20 mm) Milk Lines	1.2 gal/10 ft (1.5 L/m)
1 1/2 in. (38.10 mm) Discharge Line	0.8 gal/10 ft (1.0 L/m)
2 in. (50.80 mm) Discharge Line	1.4 gal/10 ft (1.7 L/m)
Weigh Jar	1.0 gal (3.78 L)/unit
Milk Meter	0.5 gal (1.89 L)/unit
Receiver	3.0 gal (11.34 L)/receiver
Vat	Additional 7.0 gal (26.5 L) or 25% of above (use larger value)

at least 160°F (71.1°C) at the start of the washing cycle, i.e. start of vacuum pump.

At colder ambient temperature, wash with more hot water or start at a higher water temperature. For example, at 30°F (-1.1°C) ambient temperature, 20-25% more water must be added or wash must start at 175° to 180°F (79.4° to 82.2°C). If wash starts at a lower 150°F (65.6°C) water temperature, add about 25% more hot water.

S MILK LINE OR WASH LINE SUPPORTS

S1 Permanently installed pipeline supports should not be suspended from ceiling or joists in barns in which heavy feed, etc. is stored overhead. Supports should be spaced no more than 10 ft (3050 mm) apart. A support should be provided within 2 ft. (610 mm) of every direction change.

T REFERENCES

- T1 3-A Sanitary Standards for Centrifugal and Positive Rotary Pumps for Milk and Milk Products, Number 02-.
- T2 3-A Sanitary Standards for Milk and Milk Products Filters Using Disposable Filter Media, Number 10-.
- T3 3-A Sanitary Standards for Plate Type Heat Exchangers for Milk and Milk Products, Number 11-.

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| <p>T4 3-A Sanitary Standards for Tubular Heat Exchangers for Milk and Milk Products, Number 12-.</p> <p>T5 3-A Sanitary Standards for Farm Milk Cooling and Holding Tanks, Number 13-.</p> <p>T6 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-.</p> <p>T7 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-.</p> <p>T8 3-A Sanitary Standards for Farm Milk Storage Tanks, Number 30-.</p> <p>T9 3-A Sanitary Standards for Uninsulated Tanks for Milk and Milk Products 32-.</p> <p>T10 3-A Sanitary Standards for Polished Metal Tubing for Dairy Products, Number 33-.</p> <p>T11 3-A Sanitary Standards for Pressure and Level Sensing Devices, Number 37-.</p> <p>T12 3-A Sanitary Standards for Plug-Type Valves for Milk and Milk Products, Number 51-.</p> <p>T13 3-A Sanitary Standards for Thermoplastic Plug-Type Valves for Milk and Milk Products, Number 52-.</p> <p>T14 3-A Sanitary Standards for Compression-Type Valves for Milk and Milk Products, Number 53-.</p> | <p>T15 3-A Sanitary Standards for Sanitary Fittings Used for Milk and Milk Products, Number 63-.</p> <p>T16 3-A Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products, and Product Contact Surfaces, Number 604-.</p> <p>U APPLICATION TO INSTALL PIPELINE MILK-ING SYSTEMS</p> <p>U1 After application has been made, as in Section G, the applicant should be notified promptly of any necessary changes.</p> <p>U2 Each "type" of a manufacturer's standards unit may be made available by the dealer to the proper control authority, for general approval for installation in the control authority's jurisdiction at anytime. It is recognized that any manufacturer's so-called standards do not fit all operating conditions of all users. Therefore, if any installation requires deviations from the standards already generally approved for use in the jurisdiction, the details of all deviations must be submitted with the initial application for installation and approval received prior to the installation. It is urged that deviation details thus submitted be acted upon by the control authority promptly after being received.</p> <p>U3 It is recommended that all milk control authorities adopt an "Application to Install or Modify a Milking System" form.</p> |
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¹The data for this series are contained in the *AISI Steel Products Manual, Stainless & Heat Resisting Steels*, November 1990, Table 2-1, pp. 17-20. Available from the American Iron and Steel Society, 410 Commonwealth Drive, Warrendale, PA 15086 (412) 776-1535.

²Steel Founders Society of America, Cast Metal Federation Building, 455 State Street, Des Plaines, IL 60016 (708) 299-9160.

³Adhesives shall comply with 21 CFR 175 – Indirect Food Additives: Adhesives and Components of Coatings. Document for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 783-3238.

⁴Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 (610) 832-9500.

⁵Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2392 (212) 705-7722.

⁶Available from American Society of Agricultural Engineers, 2950 Niles Road, St. Joseph, MI 49085-9659 (616) 429-0300.